A **ROOT** is a value that produces a function value of **ZERO**.

Example: 3 is a **ROOT** of $f(x) = 2x^3 - 3x^2 - 10x + 3$ because $f(3) = 2(3)^3 - 3(3)^2 - 10(3) + 3 =$ **0**

4 is **NOT** a **ROOT** of $f(x) = 3x^3 - 10x^2 + x - 5$ because $f(4) = 3(4)^3 - 10(4)^2 + (4) - 5 =$ **31**

If $(x - c)$ is a **FACTOR** of $f(x)$, then it follows that c is a **ROOT** of $f(x)$.

Example: $(x + 2)$ is a **FACTOR** of $f(x) = 10x^3 - 11x^2 - 47x + 30$ since the remainder is **ZERO**. ***THEREFORE…***

-2 is a **ROOT** of $f(x) = 10x^3 - 11x^2 - 47x + 30$

REMAINDER THEOREM: If $(x - c)$ is divided into the polynomial function $P(x)$, the remainder is the equivalent of the value of $P(c)$.

Example: The **remainder** of $f(x) = 3x^3 - 10x^2 + x - 5$ **divided by** $(x - 4)$ is **31**. Therefore, the value of **f(4) = 31** (and 4 is NOT a root of the function)

So…

What is the remainder of $(2x^3 - 17x - 8) \div (x - 4)$? DO NOT ACTUALLY DO THE DIVISION!!!

Is $(x - 4)$ a factor of $2x^3 - 17x - 8$?

Is **4** a **root** of the function $f(x) = 2x^3 - 17x - 8$? Why or why not?

How do we know how many roots a function has???

The Fundamental Theorem of Algebra

The number of roots of a function is equal to the **DEGREE** of the function (or every 2 less).

Furthermore….

DesCartes Rule of Signs

(Function MUST be in standard form FIRST)

1) The number of **POSITIVE ROOTS** of a function is equal to the number of sign changes in the terms of that function. (or every 2 less)

2) The number of **NEGATIVE ROOTS** of a function is equal to the number of sign changes in the terms of that function ***AFTER*** (-x) has been substituted into function. (or every 2 less)
{This means the **ODD** exponent terms change to the opposite sign, then count the changes}

Example: $f(x) = 2x^3 - 3x^2 - 10x + 3$